

# TELEPHONE DIALER WITH ARITHMETIC CALCULATION CAPABILITY AND VISUAL DISPLAY OF DIGITS

The present invention relates to a new and improved telephone subscriber facility.

In accordance with the invention it is suggested to provide a regular telephone subscriber unit with handset, transmission portion, and dial facility. Preferably, but not necessarily, the dial tone facility is of the touch tone type. The dial facility as presenting distinctive manifestation of digits dialed-in, provides these manifestations exclusively or additionally to an integrated circuit type storage facility. Particularly, and for example, a keyboard of the type used for touch tone dialing operates a switching matrix to provide two separate and unique switch states per operated key. The two separate switch states are now coupled respectively to a cyclically operated interrogating system operating, for example, in sequence of the matrix rows with sub-cycles provided to run through a sense system (for example, on the columns of the matrix). This way, sequentially dialed digits are sequentially loaded into an input circuit of the desk calculator type. A desk calculator includes storage facilities for storing keyed-in digits, and it includes an output circuit preparing the digits as keyed-in for display, and also for controlling the display thereof.

These components are also used here, i.e., there is a controlled display board or panel on which the keyed-in digits are dynamically displayed, i.e., on a repetitive basis, above the visual flicker rate, so as to minimize circuit connections external to IC-chips that provide for the storage and output control. As a dialed number is, thus, displayed, the user has immediate visual verification of his dialing operation. As the number has been stored, storage may persist indefinitely, rendering the number available for immediate or later use. A particular dial out key and translating circuitry is provided so that upon operation of the dial out key, the previously dialed-in and still stored number is now used to automatically affect dial-out. Thus, circuitry is provided to couple the output circuit as controlling the display to the telephone dialing facility to obtain the desired dial-out.

It is very convenient and can be effected with only little additional circuitry, to complete the circuit arrangement so as to establish a desk calculator proper. For this, it has to be born in mind, that the data input, storage, and storage and display control circuits, are already provided and perform many of the functions needed for a calculator. The circuits are particularly included in IC-chips. The circuitry on these chips can be extended essentially through selection of appropriate masks, to include provision for effecting arithmetic operation so as to cause arithmetic operation on sequentially keyed-in multi-digit numbers. The keyboard requires some extension so as to include operational keys, but they are to the most part included in the matrix arrangement for the digit keys.

It can, thus, be seen that a combined telephone dial display desk calculator is established with plural sharing of components. This is of particular advantage, as the keyboard of the desk calculator is one of the major items of that facility. By sharing it with a telephone, a unit of considerable economic value is established, offering the added advantage of sharing the display of the desk calculator with the telephone for verification of

dialed-in digits. Moreover, the desk calculator circuitry, particularly the entry, assembling and display control circuitry fits into micro electronic parts and thus occupies very little space.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention, it is believed that the invention, the objects and features of the invention and further objects, features and advantages thereof will be better understood from the following description taken in connection with the accompanying drawings in which:

FIG. 1 illustrates a block diagram of an overall view of the system in accordance with the preferred embodiment of the invention; and

FIG. 2 illustrates a circuit and logic diagram of a detail of the system shown in FIG. 1.

Proceeding now to the detailed description of the drawings in FIG. 1 thereof is illustrated a keyboard 10 which can be described as a supplemented, conventional touch tone telephone keyboard. The keyboard pertains to a telephone which includes the usual handset 18 and line switch 17 for connection to a subscriber line 15. Additional telephone circuitry for the subscriber outlet is contained in box 16; it is conventional and includes ringing circuitry, holding connection, multiple line connections, etc. With exception of handset 18 (though not necessarily) all elements described in the following will be contained in the housing of which keyboard 10 constitutes the front panel.

The keyboard includes the usual 10 digit keys 10-0 to 10-9 for dial-in figure entry. These keys are arranged in a 3x4 matrix as is conventional for touch tone phones. However, for purposes of practicing the invention that matrix has been increased by one row to have a 4x4 arrangement of keys. The additional keys are operational keys and will be introduced shortly.

As is conventional, upon pressing of any of such keys two switch bars are being closed. One switch pertains to a row bar which can be called a row switch bar, the other switch can be called a column switch bar; rows and columns refer to the matrix. The columns of the matrix switch arrangement are defined by column switch bars 21 (21-1, 21-2, 21-3, 21-4). The four row switch bars are collectively designated by reference numeral 11, and they are distinguished by reference numeral 11-1, 11-2, 11-3 and 11-4. The switch bars 11 and 12 connect to a particular integrated circuit chip 20, whereby, for example, the bars 11 connect to sense lines, while the four bars 12 receive interrogation pulses from that chip. The integrated circuit chip 20 and the particular circuit it contains is described in greater detail in co-pending application No. of common assignee, as input chip of a desk calculator.

In essence what is described in that co-pending application is an integrated circuit chip which provides interrogation signals into a first set of output lines, one signal at a time, and on a cyclically, repetitive basis. The repetition rate is very high and at a clock pulse frequency which for these interrogation signals is in the hundred kilocycle range. Furthermore, there is described in this co-pending application that upon pressing an input entry key a particular interrogation pulse is transmitted into a particular sense line and is being received by the internal circuit of the input chip to be processed, whereby the combination of timing of the interrogation pulse and arrival through a sense line, is